



Presentation to CALFED WUE Subcommittee
November 5, 2002

Agricultural Drainage Desalination

- Opportunity
 - Technology
 - Economics
 - What's Happening
-

By Ron Enzweiler, Principal, WaterTech Partners

WaterTech Partners

- ◆ Private consulting & contract R&D firm
- ◆ Ronald Enzweiler, Principal/Owner
 - B. Ind. Engrg., MS Civil Engrg., MBA, P.E.
 - managed over \$25 mm in R&D projects in career
 - Affiliated with CIFAR at UC Davis
- ◆ Current CALFED contracts:
 - \$200K Ag WUE: Irrigation Efficiency Study
 - \$316K ERP/WQ: Ag Drainage Recycling (pending)

CALFED program impacts

◆ Ecosystem Restoration

- Se, boron & salinity TDMLs for SJR
- large evaporation ponds wildlife hazard

◆ Bay-Delta Water Quality

- 80% of Se load from ag drainage (USGS)

◆ Water Use Efficiency (recycling)

- Potential cost-effective “new water” source

“Problem
(GW < 5 ft
= 743,000

"Potential Area"
(5 ft < GW < 15 ft)
= 763,000 acres

(1997 DWR data)

Potential “new water” from drainage

	Area ¹ (acres)	Rate ² (AF/ac)	Flow (AF/yr)	Current Disposition
Grasslands ³	36,500	0.35	12,800	Drain to SJR
Westlands ³	228,000	0.35	79,800	Perched GW
Tulare	301,000	0.20	105,400	Evap Ponds
Kern	58,000	0.35	20,300	Perched & EP
Total	623,500		218,300	

1 DWR Monitoring Report (3/00) & USBR Drainage Service Re-Evaluation Report (12/01)

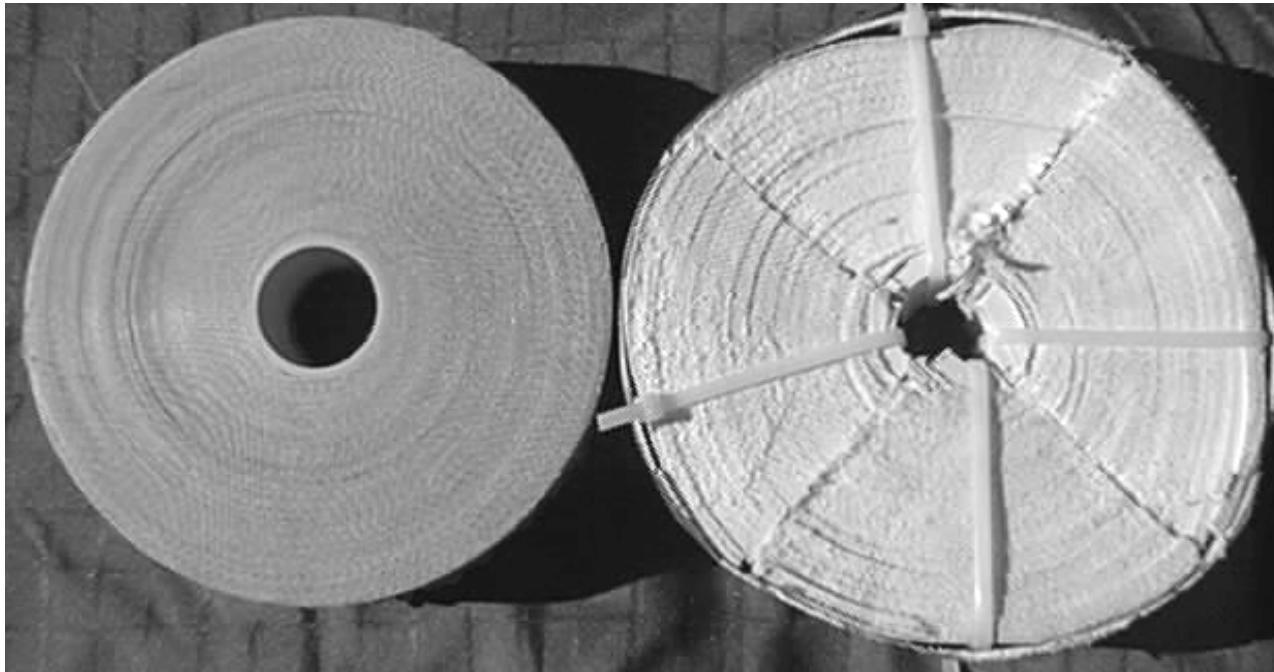
2 Source Reduction Final Report (2/99), SVJ Drainage Implementation Program

3 Omitted as “Potential Irrecoverable Losses” in Table 1-2 of CALFED WUE Plan (7/00)

Existing inoperative RO plant in Panoche



CaSO_4 (gypsum) fouling of spiral membranes



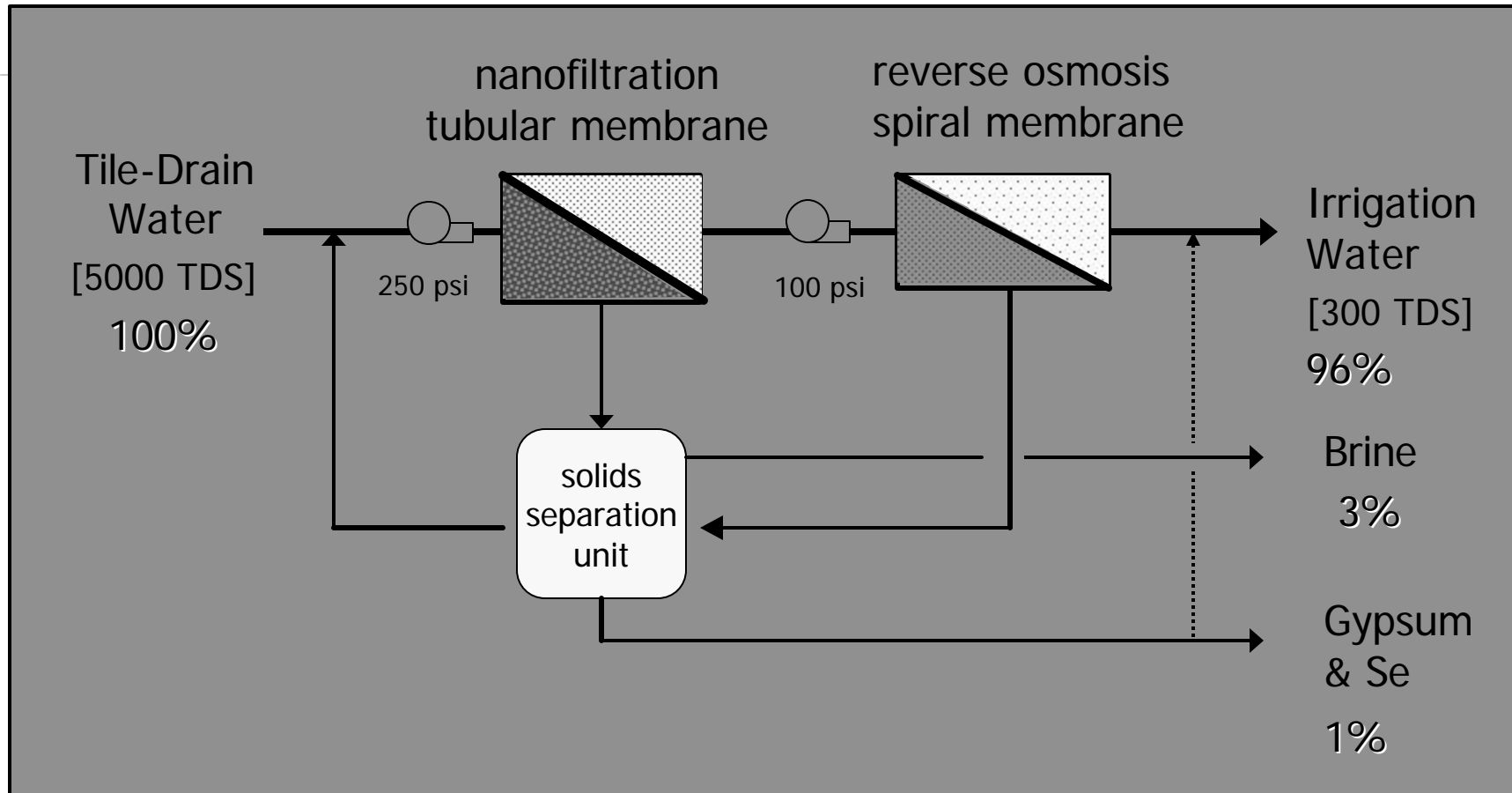
normal spiral
cross-section

passages blocked
with precipitated CaSO_4

Why is recycling w/RO now feasible?

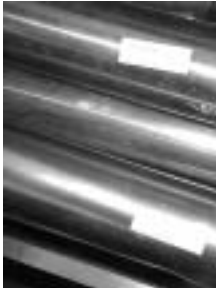
- ◆ Expiration in 2000 of “seeded RO” patent
- ◆ Plastic modules for tubular NF membrane
- ◆ Better boron rejection RO spiral membranes
- ◆ No treatment option works ($\text{Se} < 5 \mu\text{g/L}$)
- ◆ Seawater RO reality in California ($< \$800/\text{AF}$)
- ◆ SB 221 (the “show me the water” law)

Schematic of DP³RO™ Ag Drainage Recycling Process*



* **D**ouble **P**ass **P**referential **P**recipitation **R**everse **O**smosis

Membrane tests now in progress*



Different
PCI tubular
membranes

Test system & crew at Walnut Creek shop

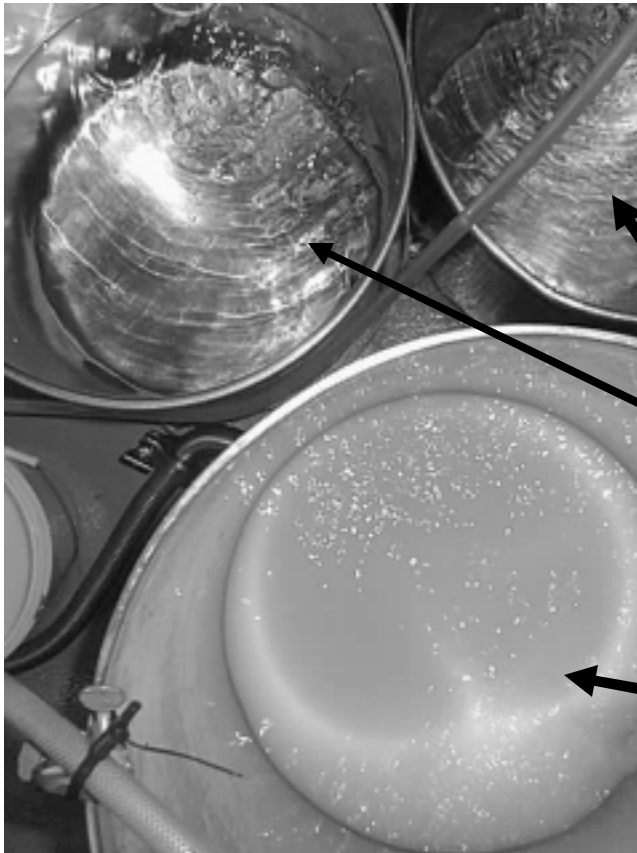


Water from
Panoche



*funded by \$75K PIER grant from Calif. Energy Commission

Tile-Drain Water (feed) →



Clean water (permeate)

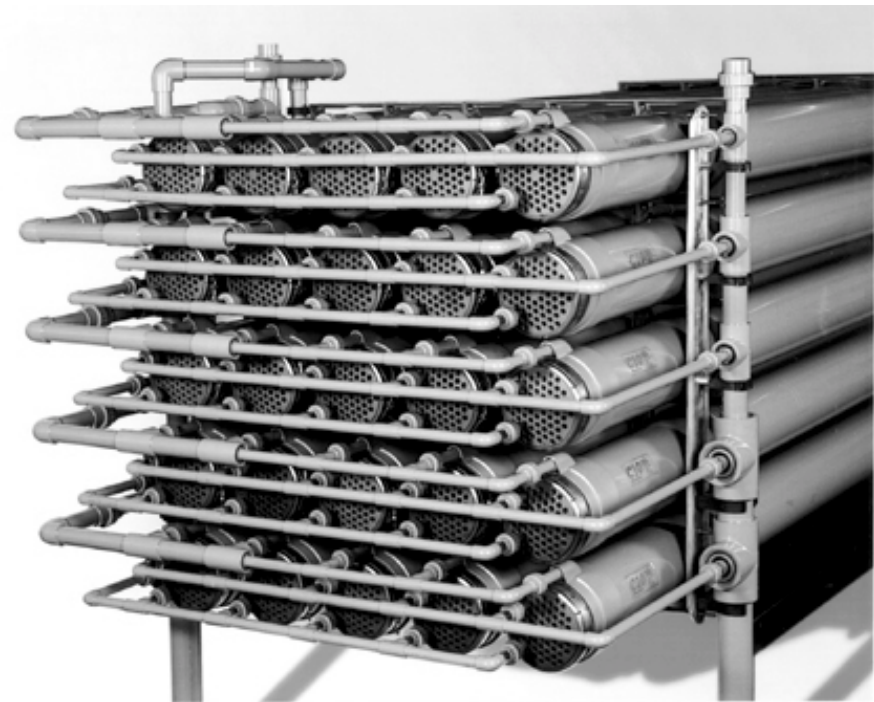
Solids & Brine (concentrate)

Tubular membranes in plastic modules now available

Full size (300 AF/yr) ag drainage plant will need 9-12 skids like this



This technology in use
for drinking water supply
in rural areas of UK
Canada and Colorado




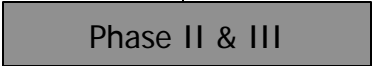

Difference Ag Drainage vs. Seawater RO




	Ag Drainage	Seawater
Salinity:	5,000 to 10,000 mg/L	> 35,000 mg/L
Feed Pressure:	100 - 250 psi	800 – 1,000 psi
Power Use	2.0 kWhr/m³	2.8 - 3.0 kWhr/m ³
% CaSO₄ Saturation:	100%	21%
Biofouling:	No	Yes
Salt Rejection:	98% (100 mg/L)	99.5% (300 mg/L)
Recovery:	>90% desirable	40% to 50%

Cost comparisons: "new water"

		Ag Drainage	Seawater
Typical Size	AF/year	300	50,000
Cost to Build:	\$/gal/day	\$4.00	\$5.00
Brine disposal:		on-site pond	ocean outfall
Operating Costs:		<u>\$/acre-foot</u>	<u>\$/acre-foot</u>
Power	\$0.08/kWh	\$195	\$300
Replacements	4 vs. 6 yrs	155	80
Chemicals, labor, services		<u>90</u>	<u>125</u>
Sub-Total:		\$440	\$505
Bond Financing	25 yrs	250	310
TOTAL		\$690	\$815

What's Happening

	\$mm	02	03	04	05
pilot plant	0.49				
full plant	2.1				
plans & EIR for network	0.60				--plant #2→

-  Ca. Energy Com.
-  Calfed ERP/WQ
-  ???

